Objection to Claims under 37 CFR 175(c)

Claims 10 and 11 are objected to under 37 CFR 1.75(c), as being of improper dependent form.

Applicants submit that claims 10 and 11, as amended, now comply with 37 CFR 1.75(c).

Rejection of Claims under 35 U.S.C. § 103(a)

Claims 1–13 and 26–28 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,605,662 to Heller et al. ("*Heller*") in combination with U.S. patent No. 6,303,943 to Yu et al. ("*Yu*"), Alivisatos, *MRS Bulletin* (February 1998) ("*Alivasatos*"), and U.S. Patent No. 3,865,550 to Bott et al. ("*Bott*").

The primary reference cited against the application is *Heller*. The Examiner relied on this publication for teaching biomaterial "to be in electrical communication" so as to have the biomaterial attached to the surface "affect" an "electrical measurement," as recited in independent claims 1 and 26. The Examiner concedes that Heller does not teach the use of nanoparticles with biomaterial shells, as recited in independent claim 1, nor does he teach sintering the particles as recited in independent claim 26. The Examiner relies on *Yu* and *Alivasatos* to supply the former element and on *Bott* to supply the latter element.

In fact, not only does *Heller* not teach nanoparticles with biomaterial shells, but *Heller* also does not refer to nanoparticles in general. Rather, *Heller* teaches a microelectronic device for carrying out molecular biological reactions. In accordance with *Heller*, various microlocations of the device are filled with specific binding entities (see, e.g., col. 15, line 56 – col. 16, line 14). Biological material is subsequently transported to the microlocations, where various reactions may take place (see, e.g., abstract). *Heller* does not teach forming shells of biological material around nanoparticles and then causing the deposited nanoparticles to be in electrical communication with at least one electrical contact, as recited in amended claim 1. *Heller* also does not teach positioning biological material to be in electrical communication with at least one layer of an electrical device formed by the sintering of nanoparticles, as recited in amended claim 26.

As noted by the Examiner, *Yu* teaches forming a phase-separated blend with nanoparticles (see., e.g., col. 19, lines 60–62). Nanoparticles dispersed in a blend, however, are not equivalent to "nanoparticles coated with shells attached to the nanoparticles," as recited in amended claim 1. The ordinary meaning of "shell," i.e., an outside covering (see, e.g., *Webster's New Collegiate Dictionary*, 1979) implies a discrete entity including an outer layer. To interpret "shell" so broadly as to encompass a blend film in which particles are merely dispersed is to virtually deprive the word of meaning.

Alivasatos discusses the formation of II-VI and III-V nanocrystals by isolating particles with a monolayer of a surfactant, and thereafter controlling the environment of the nanoparticles by exchanging the surfactant with other organic molecules (see page 18, col. 2–3). *Alivasatos* does not teach depositing nanocrystals coated with biomaterial shells onto a surface or employing the biomaterial to affect an electrical measurement. Rather, *Alivastos* utilizes his technique to form nanocrystals. *Alivastos'* nanocrystals may have organic coatings, but *Alivastos* does not teach shells of <u>biological</u> material, as recited in claim 1.

Nor does *Bott* provide what is missing in *Heller*. *Bott* merely teaches sintering round particles about 1 micrometer in diameter to remove touch contacts between the particles, thereby forming an activated metal oxide semiconducting gas sensitive element (see, e.g., col. 2, lines 28–48, and col. 5, line 54 – col. 6, line 39). *Bott* does not teach sintering <u>nanoparticles</u> to form at least one layer of an electrical device, with biological material subsequently being positioned to be in electrical communication with the layer, as recited in amended claim 26.

The Examiner notes that A*livisatos*' devices have a high impedance and suggests it would have been obvious to combine *Bott* with *Alivisatos* to sinter *Alivisatos'* nanoparticles to reduce the impedance of his devices. *Bott*, however, does not teach sintering to reduce impedance. Rather, *Bott* teaches removing touch contacts between particles in a metal oxide to produce a metal oxide material in which the oxide particles are partially sintered together, to improve the sensitivity of the material as a gas detector. One skilled in the art, therefore, would not consider sintering as taught by *Bott* to reduce the impedance of *Alivastos'* devices.

Accordingly, even if *Heller* were combined with *Yu, Alivasatos*, and *Bott* as the Examiner proposes, the subject matter of claims 1 and 26 still would not be realized; the references, alone or in combination, simply do not teach combining nanoparticles with biological material in order

to facilitate electrical measurements that are affected by the biological material. But we submit that the combinations are, in any event, improper. Insofar as *Heller* does not even mention nanoparticles, much less nanoparticles relevant to the claims herein, there exists no motivation to combine the reference with *Yu* and/or *Alivasatos* and/or *Bott*.

The Examiner has correctly noted that one cannot show nonobviousness by attacking references individually when a rejection is based on combinations of references. Applicants, however, have argued against the propriety of the combination and, moreover, have shown that even if the cited references are combined in the way suggested by the Examiner, the claimed invention would be neither anticipated nor rendered obvious.

CONCLUSION

In light of the foregoing, Applicants respectfully submit that all claims are now in condition for allowance.

Appropriate fees and forms for the RCE are submitted herewith. Applicants believe that no extension-of-time or other fee is required for this Amendment to be entered and considered. However, please consider this a conditional petition for the proper extension, if one is required, and a conditional authorization to charge any related extension or other fees necessary for entry of this paper to Deposit Account No. 20-0531.

Respectfully submitted,

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MARKED-UP COPY OF AMENDED CLAIMS

1. (Twice amended) A method of fabricating a bioelectronic component, the method comprising the steps of:

   a. providing a batch of nanoparticles having submicron sizes and an electrical characteristic;

   b. attaching at least one biological material to the nanoparticles so as to form shells of the biological material therearound, wherein the biological material is selected from the group consisting of proteins, polypeptides, nucleic acids, polysaccarides, carbohydrates, enzyme substrates, antigens, antibodies, pharmaceuticals, and combinations thereof;

   c. depositing onto a surface the nanoparticles coated with shells attached thereto[onto a surface]; and

   d. causing the deposited nanoparticles to be in electrical communication with at least one electrical contact to facilitate an electrical measurement thereof, the electrical measurement being affected by the biological material.

10. (Twice amended) [The method of claim 9 further comprising the step of forming an electrical contact according to steps comprising] A method for fabricating a bioelectronic component, the method comprising the steps of:

   a. providing a first batch of nanoparticles having submicron sizes and a first electrical characteristic;

   b. depositing the first batch of nanoparticles onto a surface;

   c. sintering the first batch of nanoparticles to form a continuous, uniform layer exhibiting the electrical characteristic of the first batch of nanoparticles, the layer having a surface;

   [prior to steps (d) – (g),]

   [i]d. providing a [third]second batch of electrically conductive nanoparticles having submicron sizes;

   [ii.]e depositing the [third]second-batch nanoparticles in contact with a portion of the layer derived from the first batch of nanoparticles; and

[iii.]f sintering the [third]second-batch of nanoparticles to form [the]an electrical contact,

g. providing a third batch of nanoparticles having submicron sizes and a second electrical characteristic;

h. attaching at least one biological material to the third batch of nanoparticles so as to form shells of the shells of the biological material therearound;

i. depositing the third batch of nanoparticles onto the layer surface formed by the first batch of nanoparticles;

j. causing the deposited second batch of nanoparticles to be in electrical communication with the electrical contact to facilitate an electrical measurement thereof, the electrical measurement being affected by the biological material.

11. (Twice amended) The method of claim 10 further comprising the steps of repeating steps (a) – ([g]j) [and (i) – (iii)] at a plurality of locations on a substrate to form an array of bioelectronic components.

26. (Twice amended) A method of fabricating a bioelectronic component, the method comprising the steps of:

a. providing a batch of nanoparticles having submicron sizes and an electrical characteristic;

b. depositing the nanoparticles onto a surface;

c. sintering the batch of nanoparticles to form at least one layer of an electrical device; and

d. positioning a biological material to be in electrical communication with at least one layer of said electrical device to facilitate an electrical measurement thereof, the electrical measurement being affected by the biological material, wherein the biological material is selected from the group consisting of proteins, polypeptides, nucleic acids, polysaccarides, carbohydrates, enzyme substrates, antigens, antibodies, pharmaceuticals, and combinations thereof.